Timber Harvesting, Migration, Growth and the Accumulation of Wealth:

Myths Versus Reality

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*Introduction*

From an historical perspective, economic development and natural resource exploitation has been synonymous in the American west. Throughout most of the twentieth century federal land management has emphasized water development,

logging, mining and grazing.  However, in recent years, there has evolved a new environmental protection argument that is essentially economic in nature.  The new view is that growth in the west is *amenity-driven* rather than *commodity-driven* and commodity exploitation threatens to thwart amenity-based development because of the damage to amenity values that arise from commodity use.  In this new view of the west, nonmarket amenity values are the fundamental basis for growth and development, not the exploitation of natural resource commodities. Of course, the policy implications in this revised view of economic development are different from the policy implications of the traditional view of commodity-based economic development.   The new environmental economic paradigm sees the protection of natural or undisturbed ecosystem values as a necessary step in economic development.  The old paradigm sees resource exploitation as necessary for development.

The purpose of this paper is to examine the veracity of the new environmental paradigm concerning regional economic development.  Following a brief review of the literature, we will test some of these environmental economic hypotheses using a cross-sectional database of Montana counties. The overriding question examined is how variation in resource exploitation and protected areas influences growth.


*Economic Growth and the New Environmental Protection Economic Paradigm*

Economic growth and development theory essentially attempts to explain changes in human well-being.  Growth theory is centered in macroeconomics and typically examines the role of investments in capital stocks, the quality and quantity of the labor force and the role of technological change in human well-being over time. Recognizing that economic development is seldom uniformly distributed in geographic space, regional economic concerns often focus on what may enhance or deter areas from sharing in economic progress.

Typically the level of well-being is measured in terms of the percapita output of the economy or percapita income.  In recent years there has been a growing criticism of this approach to growth.  For example, in recognizing that natural resources are excluded from our national income accounts, a recent National Academy of Science Committee recently recommended major modifications (Nordhaus and Kokkelenberg (1999)).  It is also recognized that important sources of human satisfaction are not accounted for in national income accounting.  For example community values, freedom from crime, and social capital are also excluded from national income accounts in addition to important environmental and amenity variables.

The environmental criticism of national income accounting is central to an emerging field of economics that is often called "environmental economics".  One central idea in this emerging field is that there is considerable "wasting" of environmental assets.  For example, depletion of natural assets is seldom included in national income accounts.  Thus economic activities that use natural assets may appear falsely profitable because no depletion expenses are excluded.  From this perspective, one would argue that some development projects should not take place when all of the relevant costs and benefits are considered.

A second more assertive form of thinking suggests that protecting assets or "nonuse" is a source of economic growth.  Much of this latter protection paradigm has

its roots in two separate but related studies.  Geographer Gunnar Rudzitis (See Rudzitis (1993), Rudzitis and Johansen (1989) and Von Reichert and Rudzitis  (1992)) was essentially interested in the study of migration patterns and the role that environmental amenities apparently play in the choice of place to live.  In particular they found that "wilderness adjacent counties" in the American west were growing much faster than other places in the country.  They concluded that environmental amenities were an important factor in the decision about where to live and that wilderness was an important environmental amenity *indicator.*  Early work by economist Thomas Power (1989) also suggested that nonmarket amenities could also be important in explaining household decisions about regional residential location decisions.  Some people willingly forgo higher urban incomes in order to live in places with high natural amenities.   Power has subsequently concluded that wilderness and wild area protection is necessary to protect the natural amenities that are important in residential location decisions.

Power (1991) and Rasker and Roush (1996) both indicate that the economies of the west are changing.  Employment growth in nonfarm jobs is related to the service sector rather than the traditional industries of the west although neither article mentions that conflict over development issues may be a reason that the traditional industries could be playing a diminished relative role in regional economies.   For example, Power (1991) argued that protecting the nonwilderness areas *outside* Yellowstone National Park would protect the local economy.

> …protecting the integrity of the Greater Yellowstone Ecosystem is not only not in conflict with local economic well being but is a crucial element in any economic development strategy in the region. (Power, 1991)

Likewise, Rasker and Roush using the same logic regarding the emerging economy of the west suggest that the traditional industries of logging, mining and agriculture are no longer important to many local economies and go a step further to suggest that "Wilderness-Land of No Use" stimulates immigration and growth.

The most recent issue that has further galvanized the development interests and the protection interests has been the Clinton Administration proposals for the management of the remaining National Forest roadless areas. Power (2000) argues in favor of protecting roadless areas by stating roadless area protection

> …does not damage our communities; it protects their future by protecting an important part of their economic base: the forested mountains and <u>all</u> of the benefits that those forests can provide to us and future generations. [1]

While it is not clear if destroying a "part of the economic base" of a community will lead to overall community decline, the threat is rather clear.  As a result, we shall examine the relationship between preserved areas, growth and personal wealth in Montana.

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[1] Since the State of Montana ranked number 1 among states in per capita income in the 1950's and now ranks approximately 47th, it is clear that changes in well-being based on income have been lower than other states.  This suggests that the value of environmental quality must be increasing in the face of all the mining, logging and cowpunching that has taken place over the last 50 years.

We have chosen to examine the relationship between development, resource use, and resource protection by examining twenty-six counties in Montana. Our analysis is much in the same spirit as that of the Rudzitis and Power studies although we have chosen the counties on the basis of their role in timber harvesting. However, it must be kept in mind that wilderness designation has never been the result of random assignment. The idea of wilderness evolved out of national forest management and most of the nation's wilderness is in the National Forest System. By choosing to analyze counties that are important in terms of timber harvesting, we have excluded many of the areas that comprise the Northern Great Plains while including areas in the Northern Rocky Mountains. It should be clear that the choice of counties that are significant in timber harvesting actually represents a choice of counties with particular amenities----forests and forested mountain landscapes. These twenty-six counties account for 97 percent of the total harvest in the state. However, thirteen of the counties also contain wilderness areas. In fact, most of the designated wilderness in Montana is located in the twenty-six county study area. We shall examine development in two different ways. First, we shall examine development in terms of population growth. This definition of growth is consistent with the Power view of the inadequacy of monetary income measures of well-being. Montana's population grew 12.9% during the 1990's. Thirteen counties in our sample grew faster than the statewide rate of growth and 13 grew slower. We have subtracted the statewide rate of growth from each county's growth rate and term the difference the <u>relative rate of growth</u> (RELGROW)[2].

Quite obviously population growth is more complex than the presence or absence of logging and wilderness. As a result, we have attempted to explain growth in a number of ways. First, we hypothesize that a set of economic characteristics for each county will influence growth. Included in these county economic characteristics are the change in the nonfarm labor force (NONFACHA)[3], the per capita size of the commercial capital stock in the county (COMMPCAP)[4] and the relative importance of the county as a retail trade center (RETAILTR)[5]. Our protection and commodity use variables is three fold. First we have a dummy variable indicating the presence or absence of designated wilderness in the area (WILD)[6]. Second we have an estimate of the level of timber harvesting in each county during the 1990's expressed on a per square mile basis (HARVPMSQ)[7]. As it turns out there is substantial correlation between the wilderness variable and the timber harvest variable so we have included an interactive variable (HARVWILD) that is the product of the level of harvest and existence variables. Model 1 in Table 1 summarizes the results of the regression predicting the relative rate of population growth.

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[2] Data available at http://Quickfacts.census.gov/qfd/states
[3] Data also available at Quickfacts.
[4] The commercial capital stock is available in Montana Department of Revenue (2000). It is the commercial and industrial land and improvements for the year 2000 in each county.
[5] The retail trade center variable is based on data from Quickfacts.
[6] The dummy variable is based on a Montana wilderness map used in Jackson and Wall.
[7] The timber harvest data for the 1990's is found in Keegan, et. al. 2001. Montana Forest Products Industry: A Descriptive Analysis. Bureau of Business and Economics Research. The University of Montana.

### Table 1
### Predicting the Relative Rate of Population Growth

```
º Dependent variable is RELGROW    Mean =    -0.00685, S.D. =        0.1400
º Model size: Observations =        26, Parameters =   7, Deg.Fr. =     19
º Residuals:  Sum of squares=   0.133437      Std.Dev. =         0.08380
º Fit:        R-squared = 0.72754, Adjusted R-squared =         0.64150
º Model test: F[  6,      19] =     8.46,    Prob value =         0.00015
º Results Corrected for heteroskedasticity
º Breusch - Pagan chi-squared =      6.7779, with   6 degrees of freedom
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| Variable | Coefficient | Standard Error | t-ratio | P[³T³ðt] | Mean of X |
|---|---|---|---|---|---|
| Constant | -0.34858 | 0.63701E-01 | -5.472 | 0.00003 | |
| NONFACHA | 0.43789 | 0.74638E-01 | 5.867 | 0.00001 | 0.2197 |
| HARVPMSQ | 7.2321 | 2.1011 | 3.442 | 0.00273 | 0.1284E-01 |
| RETAILTR | -0.23927E-04 | 0.77583E-05 | -3.084 | 0.00611 | -3033. |
| COMMPCAP | 0.29076E-04 | 0.92493E-05 | 3.144 | 0.00535 | 4388. |
| WILD | 0.18375E-01 | 0.45956E-01 | 0.400 | 0.69373 | 0.5000 |
| HARVWILD | -5.4136 | 2.1401 | -2.530 | 0.02042 | 0.1046E-01 |

Based on the overall level of F the model in Table 1 is significant. The goodness of fit (adjusted R-square) is also reasonably good. However the interpretation of the variables is most interesting. All of the variables are significant save the wilderness dummy variable at an alpha level of .05. Both the expansion of the role of the nonfarm labor force and the percapita size of the commercial capital stock are significant and positive. The role of the county as a retail trade center is negative. However, there is strong correlation between this variable and the commercial capital stock. Attempts to include an interactive variable were unproductive so the results suggest that as the size of percapita retail sales increases holding the commercial capital stock constant, we observe counties with lower rates of relative growth rather than higher ones.

The timber-harvesting variable is quite interesting. This is the way it works. For nonwilderness counties, higher harvesting per square mile corresponds with higher rates of population growth than is the case for wilderness counties. The coefficient for the level of harvesting when the wilderness variable is 0 is 7.231 while the coefficient when wilderness has a value of 1 is 1.8185 ((7.2321-5.4136). In *both wilderness and nonwilderness counties higher levels of timber harvesting correspond with higher relative rates of population growth, not lower ones.* Furthermore, holding the level of harvesting per square mile constant, the wilderness variable is not statistically significant. Variation in the level of timber harvesting is a better predictor of population growth in these areas than is the existence of wilderness, and higher rates of harvest predict higher levels of population growth, not lower growth.

Lets now turn our focus to the relationship between harvesting, wilderness and residential real estate value. For many Americans, home ownership is a significant part of total personal wealth. Thus, we decided to investigate the relationship between the relative rate of growth, wilderness, timber harvesting and residential real estate wealth in the various counties. This relationship is summarized in Table 2 below.

## Table 2
### Residential Real Estate Value, Growth, Wilderness, and Timber Harvesting

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Ordinary      least squares regression     Weighting variable = ONE
Dependent variable is RESPHOU    Mean = 1375.45282, S.D. =     630.9401
Model size: Observations =        26, Parameters =   6, Deg.Fr. =     20
Residuals:  Sum of squares=    0.251558E+07 Std.Dev. =       354.65358
Fit:        R-squared = 0.74723, Adjusted R-squared =          0.68404
Model test: F[ 5,     20] =   11.82,    Prob value =          0.00002
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| Variable | Coefficient | Standard Error | t-ratio | P[³T³ðt] | Mean of X |
|----------|-------------|----------------|---------|-----------|-----------|
| Constant | 2654.0 | 457.26 | 5.804 | 0.00001 | |
| YHAT1 | 3580.8 | 594.90 | 6.019 | 0.00001 | -0.6846E-02 |
| HARVPMSQ | -74858. | 7924.0 | -9.447 | 0.00000 | 0.1284E-01 |
| WILD | 2.0048 | 148.41 | 0.014 | 0.98936 | 0.5000 |
| HARVWILD | 73918. | 8659.2 | 8.536 | 0.00000 | 0.1046E-01 |
| PEOPHOU | -519.23 | 208.20 | -2.494 | 0.02151 | 2.055 |

The dependent variable in Table 2 is the residential real estate value per household.  It is in fact the Montana Department of Revenue (2000) residential real estate value for each county in the sample for the year 2000 divided by the year 2000 U.S. Census estimate of the number of households in each county.  Based on the F-statistic, the second model summarized in Table 2 is also significant.  The model represents a relatively good "goodness of fit" (Adjusted R-square =. 684).  YHAT1 is the predicted relative rate of growth from the equation summarized in Table 1.  We have again added the harvest variable, the wilderness variable and the interactive variable so that these coefficients must be combined with the coefficients from table 1 before they can be interpreted.  In addition, we used a qualitative variable suggestive of relative household size. PEOPHOU[8] is the average number of people per household based upon year 2000 Census information. The coefficient for this variable is significantly negative indicating that as household size increases, real estate value per household falls.

We now turn to the task of calculating the wilderness and harvesting coefficients for the second equation.  This is done by multiplying the coefficient for the YHAT1 variable (3580.8) times the coefficients for all the independent variables in Table 2 and then combining the coefficients as is shown in table 3.

## Table 3
### Calculating the Recursive Coefficients

3580.8(-0.34858 + 0.43789*NONFACHA + 7.2321*HARVPMSQ - 0.23927E-04*RETAILTR + .29076E-04*COMMPCAP + 0.18375E-01*WILD - 5.4136*HARVWILD) + 2654 – 74858*HARVPMSQ + 2.0048*WILD + 73918*HARVWILD - 519.23*PEOPHOU

= 3901.2 + 1568.0*NONFACHA - 48961.3*HARVPMSQ + 54533*HARVWILD + 67.8*WILD + .104*COMMPCAP - .086*RETAILTR –519.23*PEOPHOU

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[8] Based on data from Quickfacts (footnote 1).

The coefficients for residential Real Estate Value per household are rather intriguing.  Of course of particular interest is the relationship between value per household in wilderness versus non-wilderness counties.  For nonwilderness counties, real estate value per household is lower for counties with higher harvests than in counties with lower harvests.  However in wilderness counties, the opposite is true.  When the value of the wilderness dummy variable is 1, the combined effect of the coefficients is positive ((67.8 +(54533-48961.3)* Harvest per square mile).  Thus in wilderness counties, the higher the rate of harvest, the higher the value of real estate per household.  Of course, the signs of the other variables (NONFACHA, COMMPCAP, and RETAILTR) are the same in the recursive regression as they are in Table 1.


*Discussion*

For the most part, discussion of the economic role of ecosystem preservation has been based on anecdotal evidence.  There is evidence of structural changes in the economy based upon sectoral shifts in workforce employment.  Jackson and Sperry (1998) found that Montana employment in timber related jobs, agriculture and oil, gas and minerals fell from just less than one in five jobs to just less than one in ten jobs in a recent 25-year period.  Rasker and Roush suggest that footloose employment (jobs that can be done in any location) plays a prime role in the new economies of the American west because the environmental amenities attract people who can relocate at comparatively low costs. However, there is no objective  working definition of lone eagles and a reliable data source. In contrast, this study attributes substantial change to the role of capital as well as to the expansion of the nonfarm workforce.  While people like Power and Rasker tend to place great emphasis on the role of ecosystem reservations in the growing regions of the west, we have found that the existence of protected areas is not a useful variable in explaining growth. Instead we have found the level of timber exploitation to be a better explanatory variable.

There are a variety of possible explanations for such a finding.  First, resource exploitation may augment net immigration and growth. This may happen simply by reducing out migration or increasing in migration.  Second the level of timber harvesting may, oddly enough, be a better measure of environmental amenities within a county than the presence (or absence) of wilderness.  Most of the wilderness in Montana is located on National Forest lands.  Wilderness itself has considerable amounts of jagged peaks but may also be adjacent to productive commercial forestland or nearby private residential landscapes.  Thus, counties with comparatively high timber harvests may also be attractive places to live, work and play.  The various Rudzitis studies have carefully indicated that wilderness adjacency is an indicator of a variety of amenities and it is the wide range of amenities which includes incidentally, a value placed on a slower nonurban "pace of life" amenities.

Another important possible explanation is that current *levels of timber harvesting and harvesting practices* are not influencing aesthetics to the point that migration is affected.  There are substantial efforts to maintain aesthetic values on various forestlands.  This has translated into curbing the use and size of clearcuts, and other practices that are objectionable.  Quite possibly, the current range of timber harvesting per unit of area within the sample of counties may simply have a negligible impact on aesthetics at the county level of analysis.

One of the most substantive differences between this study and the von Reichert and Rudzitis study lies in the difference in geographic scale. If, for example, the scale of the study is every county in the country, designated wilderness may be an excellent amenity indicator. In contrast if one chooses to study counties in the forested landscapes of Montana, wilderness is apparently not a particularly good amenity indicator in terms of explaining variation in population growth. At this later scale of analysis, other factors beside the designation of wilderness are significant in predicting the relative rates of growth.

More importantly however, these models do little to substantiate that ecosystem protection (meaning no commodity production such as in wilderness areas) actually stimulates immigration and growth. Many counties are experiencing a rapid expansion of the nonfarm work force. Some wilderness counties are experiencing these trends while others are not. Commercial capital does appear to augment growth and development. Thus, if the state wants to engage in development policies, it would appear that it should pursue more traditional development policies. That suggests stimulating capital formation and helping to update a modern workforce.

Home ownership is one of the most important forms of private wealth accumulation. It is clear from the analysis that neither timber harvesting in a county nor wilderness protection are clearly related to this form of household wealth. While it has always been understood that the amenities can and often do affect real estate value, this analysis suggests that counties that are both wilderness adjacent and with high levels of harvesting will have higher real estate values per household than is the case of nonwilderness counties with high levels of harvesting or wilderness adjacent counties with low levels of harvesting. At best this indicates the need to balance development and protection decisions at the county level.

The new environmental protection paradigm is based on an interpretation of changes that are taking place in the regional economies of the west rather than more theoretically oriented models of regional growth and development. Without models of growth and development and measures of amenities, it is impossible to examine how marginal changes in amenities or other factors of growth and development affect growth and development. Does Montana have ample wilderness from the standpoint of growth and development? What are the marginal returns to changes in the protected status of landscapes? The examination of the effect of the existence of wilderness in this analysis indicates that recent population growth is not sensitive to wilderness in the counties examined. As a result, we must conclude that the empirical basis for the new environmental economics paradigm is more myth than reality.

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